

City University of Hong Kong  
Department of Electronic Engineering

# **EE3316 Information Product Design Mobile App Design Final Report Into Heart**

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Group No.: 05

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Heart is a vital organ of human body, once it stops, no matter how strong, you are gone. This app monitors heart rate all-day and evaluate heart health condition, integrates into everyday exercise training session and help user to control the exercise strength, to reach a better exercise goal, as well as training heart. With social integration, this app connects user with friends and family to motivate user care about their heart. This app also conducts emergency alert including: contacting the family, call ambulance, make noise, or any other viable first aids.

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## 1 Introduction

### 1.1 Market Research

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessel. In 2012 it kills 17 million people, makes 31% of all death in the world<sup>1</sup>. According to some researches, heart rate (HR) is an independent predictor of cardiovascular and all-cause mortality in men and women with and without diagnosed cardiovascular disease<sup>1</sup>. Heart rate was assigned the same weighting as blood pressure and cardiorespiratory fitness in the overall score<sup>1</sup>. On the other hand, It's vital to monitor your heart rate during exercise<sup>3</sup>. A target heart rate is recommended to reach best exercise goal. Time is important when heart attack suddenly occur, time is life, handling emergency situation is a problem when patient is not near there relatives.

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<sup>1</sup>WHO, Cardiovascular diseases (CVDs), retrieved from <http://www.who.int/mediacentre/factsheets/fs317/en/> on Feb 2, 2015

## 1.2 App Summary

### 1.2.1 Target User Group

This App applies to almost all the people who care for their heart health. For those who suffer from heart disease, this App is a great tool to improve their heart condition and even save their lives.

### 1.2.2 Competitive Analysis

The possible competitors in Android market are Instant Heart Rate, Runtastic Heart Rate, Heart Rate Monitor, Cardiograph, Up by Jawbone and Polar Beat. The most common method of these Apps to measure heart rate is as such: let the user put their finger on phone camera and at the same time turn on the flashlight. Usually the whole measurement will finish within one minute. The most popular one Instant Heart Rate is downloaded over ten million times. While they have few function except for measuring heart rate. Up by Jawbone and Polar Beat use external sensor, which improve the accuracy, but their function mainly focus on diet control and exercise record. As a result, our App is competitive with multiple functions. Additionally, all these Apps have few extra functions like reporting heart health condition. In comparison, our App uses an additional sensor to monitor the heart rate so that it can automatically respond to user's heart condition at any time. Moreover, we integrate many related functions together such as SOS to make it a multifunctional heart health station. From this point of view, our App is innovative enough to compete in the market. Our App is aimed to monitor the user's heart rate and give some related disease analysis results including heart rate records and some advice on heart health in the long term. In addition, our app also helps user to control their exercise life, adjust energy expenditure.

### 1.2.3 Target Platforms and Device Configurations

Item	Description
Target platform	Android 4.3 or later
Networking	required if want to use social function
Screen resolution	no restriction
Touch screen	required
Processor	mainstream is fine
Bluetooth	required, LE preferred
Accessory	Polar <sup>TM</sup> H7 Heart Rate Sensor

## 2 App Design and Analysis

### 2.1 Architectural Design

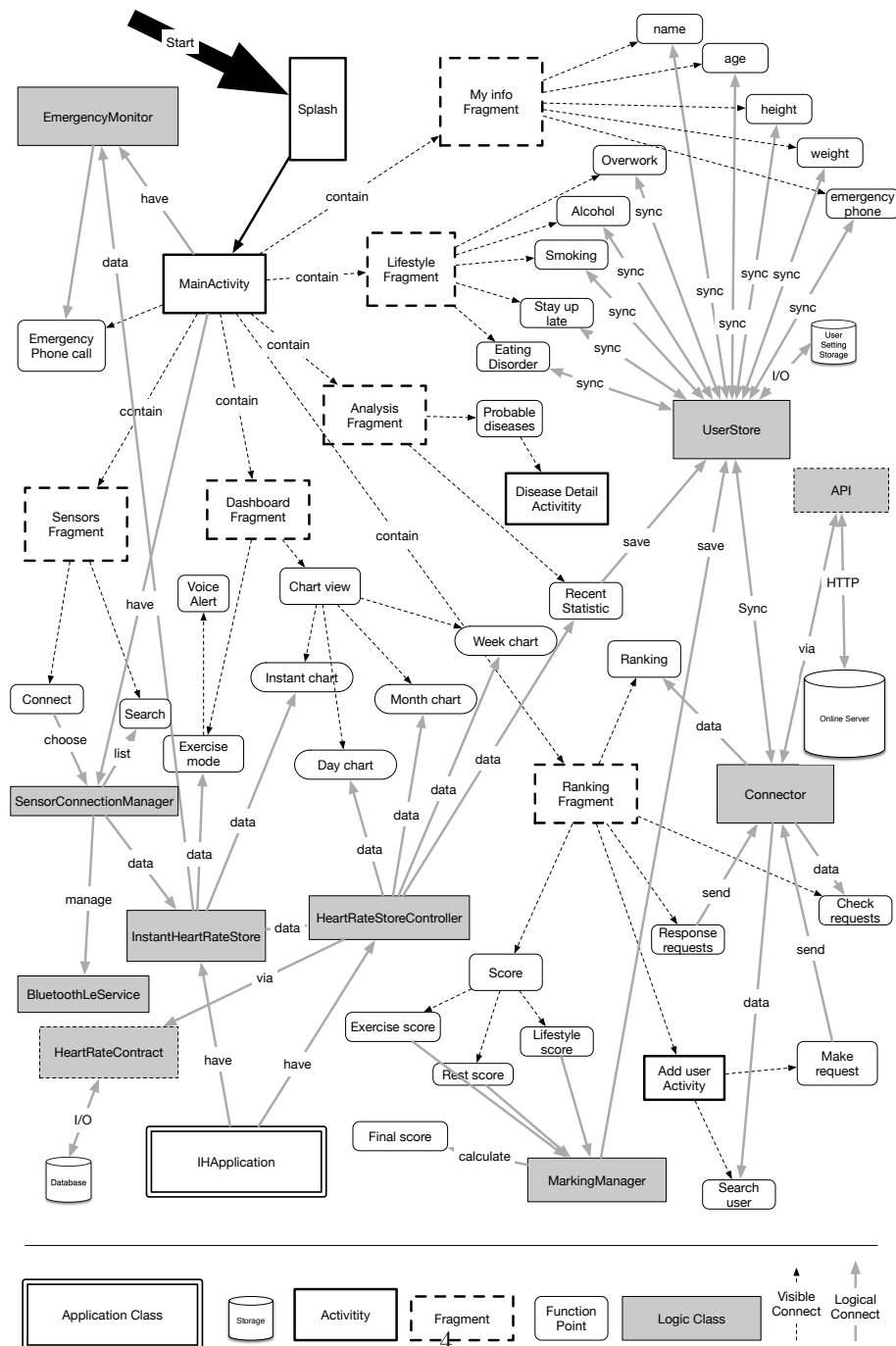


Figure 1: Into Heart Architectural Design

## 3 Configuration

### 3.1 Configuration

#### 3.1.1 App

For Into Heart App, we use Android Studio project structure with Gradle project automation tool to do package management. The project bone structure is as followed.

**IHApplication.java** is the Application class and holds global variables.

**MainActivity.java** is the main activity with a navigation drawer to navigate between fragments, also the inner class EmergencyMonitor monitor heart rate and make emergency call when necessary.

**NavigationDrawerFragment.java** is navigation drawer fragment, let user navigate between fragments.

**DashboardFragment.java** is under MainActivity and let users view the instant heart rate and historical charts, as well as exercise mode.

**AnalysisFragment.java** is under MainActivity and let users view their recent heart rate analysis result and the diseases they might have.

**SensorsFragment.java** is under MainActivity and let users search the sensors nearby and connect to them.

**RankingFragment.java** is under MainActivity and let user view their score and the ranking among friends. Searching friends, sending friend requests and responding the requests are in this fragment.

**UserInfoFragment.java** is under MainActivity and let user set their basic informations such as name, age, weight, height and emergency telephone.

**LifestyleFragment.java** is under MainActivity and let user rate their lifestyle, including smoking, alcohol, eating disorder, stay up late and overwork.

**AddFriendActivity.java** can be entered from RankingFragment, letting user search and send friend request.

**RawDataActivity.java** let user view the raw data of data tale "day"

**SettingsActivity.java** responds the interaction when user clicks on the setting page.

**Splash** Splash page.

**DiseaseDetailActivity.java** shows the detail of a particular disease using a WebView.

**UIComponent/SimpleAlertController.java** is just a wrapper of AlertDialog, for easier usage.

**HTTP/API.java** defines the communication prototype between app and server.

**HTTP/Connector.java** defines the methods to use API to communicate with server.

**HTTP/JCallback.java** is just a wrapper for handler, for easier asynchronous programming especially in networking.

**HTTP/Outcome** is the Data model passing in JCallback.

**Data/HeartRateContract.java** defines the database model and some simple query/insert methods.

**Data/HeartRateStoreController.java** controls all data coming in/out the database.

**Data/InstantHeartRateStore.java** stores the recent 60 heart rate data from sensors.

**Data/MarkingManager.java** defines the rules of marking scores.

**Data/UserStore.java** is the controller to control the user's info and scores, sync the data with server using Connector and sync the data locally using **SharedPreferences**.

**BLE/BluetoothLeService.java** is registered service to communicate with Bluetooth LE device.

**BLE/GattAttributes.java** stores some constants conforms to Generic Attribute Profile.

**BLE/SensorConnectionManager.java** manages the connections between sensor and app, also handle the data sent from sensor and pass to other objects.

**res/layout/\*** are the layout files defines the static layouts used by activities, fragments, alert dialogs and lists.

**res/menu/\*** define the action menu bar's items.

**res/drawables-\*/\*** and **res/minmap-\*/\*** are image resources.

**res/values/\*** define the string constants and other static resources.

**res/xml/\*** define the setting items.

### 3.1.2 Server

Since the stress is not on the server side, only the basic configurations are mentioned below.

For rapidly development, our server-side choice is to use Ubuntu 14.04 server version as OS, with node.js server application, express framework and MongoDB database system.

**routes/users.js** handles all requests with endpoints `/users/*`.

**models/models.js** defines the data models.

**app.js** initialize and starts the application, making connection with database.

## 3.2 Known Issues

**Crash when switching fragment while networking work not finished.** When networking is still on, quickly switch fragment cause fragment detached, then "getActivity()" will return null which further cause crash of the app. Some optimization like null checking is added, the bug emerges less.

**Old version of lifestyles or other settings takes place of right version when network condition is not well.** There exists a case where the fetching from server starts, user modifies the lifestyle rating, and the modified data is transferred to server, at this time or then, the previous fetching finished, the old lifestyles overwrite the local ones, and when user does changes based on this old version, it will misleads the e data is not synced. This bug is being fixed and emerges sometimes.

**TTS fails to get the speaking status.** In exercise mode, the speaking status cannot be got which would be used for preventing voice from erupting at same time. Currently fallback is let TTS not receiving any request for 10 seconds after each request, or called "cool down period".

**Not be able to keep exercise mode.** When in exercise mode, if user change to other pages by navigation menu, after coming back to "Dashboard", the mode turns back to normal mode, but not remains on the exercise mode.

**Exercise mode backs to Normal mode when switch out the dashboard then back.** This is because the exercise mode is hosted in dashboard fragment, currently the best solution is to move the entire related code to the activity, while there is a lot work to do and no time for this.

### 3.3 User Manual

1. Press "Into Heart" icon to launch the application
2. After the open page, you could see the menu and "Dashboard", choose "Sensor" in menu and wear the H7 sensor. If your are asked to turn on the Bluetooth, choose "Allow". Build the connection between your device and the sensor.
3. Go to "My info" page to create account if it is your first time to use this app, then log in by pressing the "Log in" button. You could modify your age, height, weight as well as emergency number, and save.
4. More functions:
  - Save your life: In the "Dashboard", your heart rate could be detected and shown in day, week, and month. On the right corner, you could change the mode between "Normal Mode" and "Exercise Mode". If your heart rate is irregular, the system would automatically call to your emergency number to save your life! Exercise mode would give you an artificial voice reminder.
  - Analysis: This page will show your average, maximum, minimum heart rate and give you an analytical result of your health condition. Press "View details", then you can see a WikiPedia list about different heart diseases.
  - Sharing with friends: If you has logged in, you could see your health score and ranking between your friends in "Ranking" page, press the add friend button you could also search for and add new friends.
  - Record: In the "Life Style" page, you can press on either icon to set your life habits.